

**Indiana University-Purdue University  
Indianapolis**  
**Department of Mathematical Sciences**

STATISTICS SEMINAR

12:15pm—1:15pm, Tuesday, September 22, 2020  
Zoom Meeting: Meeting ID: 751 025 519

**Speaker:** Jeong Hoon Jang

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**Title:** Principal Component Analysis of Hybrid Functional  
and Vector Data

**Abstract:**

We propose a novel principal component analysis (PCA) framework that provides a nonparametric means of simultaneously reducing the dimensions of and modeling functional and vector (multivariate) data. We first introduce a new hybrid Hilbert space that combines functional and vector objects as a single hybrid object. The framework, termed a PCA of hybrid functional and vector data (PCA-HFV), is then based on the eigen-decomposition of a covariance operator that is formulated in the new hybrid space and captures the variability within and between functional and vector data. This approach leads to interpretable principal components that have the same structure as each observation and a single set of hybrid principal component scores that serves well as a low-dimensional proxy for hybrid functional and vector data. We propose a simple and robust estimation scheme where components of PCA-HFV are calculated using the components estimated from the existing functional and classical PCA methods. The proposed estimation scheme allows flexible incorporation of sparse and irregular functional data as well as multivariate functional data observed on same or different domains. We derive the consistency results and asymptotic convergence rates for the estimated components of PCA-HFV. Our simulation results demonstrate satisfactory finite-sample performance of the proposed framework. We demonstrate the application of our method using a renal study.